Enclosure with openable and closeable lateral walls and roof surfaces, and sliding door thereof

The invention relates to an enclosure (housing) with the features of the preamble of Claims 1, 16, and 17, as well as to a sliding gate for this housing.

Housings according to this class are known from DE 100 41 257 A1 and are used, e.g., for housing galvanic tanks, e.g., for zinc coating large components, but are also suitable for lacquer cabinets and the like. For this known housing, the two side walls and the entire roof section can be closed by two symmetrical cloth-like hangings. In the open state, the hangings are wound onto wind-up shafts close to the floor on both sides of a galvanic tank. For closing the housing, the hanging on each side attached to an end bar at the full width is moved from the open to the closed position by a vertical two-ended guide, which changes to an approximately horizontal guide in the roof region. To enable the necessary lateral spreading for achieving an approximately cubic housing space in the roof region, in the same end guided for each hanging, one or two support rollers are moved, which in the closed state enable the deflection of the hanging from an approxi-

mately horizontal roof region into the approximately vertical side wall region and which themselves extend past the entire hanging width.

Such housings have proven to be useful for housings of galvanic tanks that can be opened completely towards the top. However, considerable bending-related problems are created, primarily with tanks that become longer, i.e., with side walls that become longer, because both the end bars and the hanging, and also the support rollers and the wind-up shaft are exposed to considerable deflection. In the closed state, this leads to considerable cross-sectional dimensions of these loaded components, as well as to sagging of the hanging in the roof region, and, in the open state of the housing, in which these components are arranged in their side guides one above the other, to considerable and largely interfering structural heights. Primarily the wind-up shaft arrangement, which can also be raised and lowered, has considerable space requirements, especially large cross-sectional dimensions. This impairs, among other things, also the transport of goods, e.g., components to be zinc coated, from the longitudinal side. In addition, the end side walls represent a length limit for the usefulness of the housing. It is not possible to transport components projecting past the end of the housing on one or both sides from above, e.g., with a crane, into the housing and definitely also not in the open state of the hanging.

Starting with this background, the invention is based on the problem of creating a housing according to the preamble of claim 1, 16 or 17, in which, in the open state, impairments for goods transport into or out of the housing are reduced. Another problem is

that a housing according to the preamble of claim 1, 16 or 17 can be erected with smaller and/or fewer components.

The solution according to the invention consists in a housing with features of Claims 1, 16, and/or 17, as well as in a sliding gate for this housing with the features of Claim 18. Consequently, the invention is based on the basic idea of being able to realize other components of the housing or sliding gate for this housing with smaller dimensions or being able to completely eliminate individual components, such as the support rollers, by means of a multifunctional, relatively wide end bar. Especially preferred is a bar according to the invention formed like a support-surface or wing like profile. Thus, one is in the position of being able to span very large side wall lengths, e.g., of 18 meters and more, without supports. The roof section can be closed relatively tight, especially if the known hangings of the closing element there are avoided to the greatest possible extent. The components named above and also the claimed components and the components to be used according to the invention described in the embodiments feature no special conditions in size, shape, material selection, and technical design, so that the selection criteria known in the field of the application can be used without restrictions.

Further details, features, and advantages of the subject matter of the invention follow from the sub claims and also from the description below of the associated drawing, in which, as an example, a preferred embodiment of a hall according to the invention with side walls and roof sections that can be opened and closed is shown. Shown in the drawing are:

Figure 1, a enclosure (housing) in vertical section parallel to an end wall in the closed state;

Figure 2, the same housing in the completely open state;

Figure 3, the same housing with closed roof and raised side walls;

Figure 4, the same housing in view from the top, open at the top and without roof profile;

Figure 5, the same housing in side view, closed;

Figure 6, an alternative configuration of a housing with motors arranged on the floor and counterweights for an approximately halfway open roof;

Figure 7, the same housing with motors arranged on the floor with closed roof;

Figure 8, an end bar for a housing according to one of Figures 1 to 7 as a suction channel - section-wise;

Figure 9, a collapsible cantilever surface in the bottom and top position;

Figure 10, a foldable cantilever surface in the bottom and top position; and also

Figure 11, another foldable cantilever surface in the bottom and top position.

As is visible from Figures 1 to 3, a housing 10, e.g., for housing a galvanic tank 12 or as a lacquer cabinet or the like, comprises end walls 14A, 14B and side walls 16A, and 16B, as well as roof sections 18A and 18B. The side walls are each formed by a hanging 20A, 20B that can be wound up as much as possible without deformation. The roof sections are formed from components, which, in contrast with the side walls, are not flexible, and comprise end bars 22A, 22B, which extend over the entire housing length and which can be moved in end guides 26A, 26B by means of corresponding guide means, such as track rollers 42A, 42B, over a vertical region and an arc region connected at the top along the side wall zone into the roof zone and back by means of a simple traction cable 40A, 40B that can be wound up and that is deflected especially at 50A, 50B. Preferably, free cantilever surfaces 32A, 32B, and 34A, 34B are formed on both ends on the end bars 22A, 22B, so that a relatively bending-resistant, support surface-like overall profile is created in the direction of the housing length to be spanned (covered), so that this profile essentially forms roof sections 18A, 18B. In the open state (Figure 2), this overall profile is oriented approximately vertically and if necessary can be countersunk, e.g., in the floor or a side rail, while in the closed position it is oriented essentially horizontally or with a slight slope outwards.

In the closed state, wind-up shafts 24A, 24B that can be driven by a motor form the bottom hanging end. Preferably, the wind-up shafts 24A, 24B can be guided and displaced

vertically, especially in the already mentioned guides 26A, 26B by guide means, such as rollers 46A, 46B, wherein the raising and lowering can be performed both by a standalone drive and also - as shown - after releasing locking devices, by the activation of the wind-up drive 38A, 38B for the hanging, wherein a weight compensating device 36A, 36B is used with counterweights. Therefore, the side walls can also be raised from below and opened, if necessary, up to the vicinity of the roof (see Figures 6 and 7, description below). The side wall hanging 20A, 20B, which is fixed at one end to the laterally projecting end region of the end bar 22A, 22B and which is fixed there continuously or at intervals preferably to the projecting end of the cantilever surface 32A, 32B over its entire length, is fixed at its other end to the wind-up shaft 24A, 24B in a corresponding way.

Because the bottom wind-up shaft 24A, 24B is fixed to the hanging 20A and is guided only by the guides 26A, 26B, damping characteristics are provided if explosions occur. Such explosions occur frequently near hot zinc spatters in zinc coating plants. The pressure wave generated by the explosion throws up to a few tons of zinc against the inner side of the hanging 20A, 20B, whereby this hanging experiences an outwards directed pressure and expands accordingly if it is expandable and/or it deforms. Because the wind-up shaft 24A, 24B is not nailed rigidly but instead can move freely upwards, raising the wind-up shaft 24A, 24B allows the hanging 20A, 20B to deform due to the explosion. The resulting damping of the pressure wave reduces the likelihood of ripping the hanging 20A, 20B or other damages.

In addition, the hanging 20A, 20B comprises a textile with a special rubber alloy, so that there is a lubricant film for hot zinc spattered against the inside of the hanging 20A, 20B. The zinc can slide downwards along this film without damaging the textile. Here, both a permanent lubricant film and also a melted lubricant film generated by the heat of the zinc spattered against the textile can be used.

In case of appropriate material selection, especially by low-expansion hanging types, such as lattice-reinforced planes or films, the wind-up shaft is stabilized against bending by the end bars by means of the hanging and in the extreme case it is supported to a large extent. This arrangement is also worthy of an invention by itself. Therefore, the wind-up shaft can have a relatively small cross-sectional dimension despite a very large length, e.g., of 18 meters. Incidentally, the cantilever surfaces 32A, 32B pointing outwards with their free edges act as hanging braces and can pivot outwards with reference to the guide rails.

It is understood that motors 44A, 44B are used, which are suitable for raising and lowering the end bars 22A, 22B and which enable the raising and lowering of the end bars by means of correspondingly deflected traction cables or the like, wherein typical weight compensating devices can be used, e.g., under the use of counterweights or suitable spring elements.

Here, especially for medium-length or longer systems (above ca. 10 m length), preferably two synchronously controlled motors 44A are used per side, as can be seen well in

Figure 5. Because these can be operated without mechanical forced synchronization (such as, for example, in the form of a continuous shaft extending in the longitudinal direction), they are preferably arranged in the top region of the housing 10, so that the motors 44A can exert an upwards directed traction force needed for closing the housing 10 directly from the advantageous top position.

In especially shorter systems, optionally, expensive synchronous motors can be eliminated and instead of these motors 44A, 44B, continuous shafts can be used. These can be arranged for various reasons (safety concerns, required support of the shaft, simplifying maintenance work, etc.) in the bottom region of the housing 10 or the system. For example, there is an attachment to a safety landing or to the floor (see Figures 6, 7). If the continuous connection shaft could have a disruptive effect (e.g., side access obstacle), a driving arrangement can also be embedded under the floor or in the foundation. If the motor 44A, 44B is arranged in the bottom region, usually another guide roller 52A, 52B is needed. In addition, in the embodiment shown in Figures 6 and 7, the deflection rollers 50A, 50B rotate opposite the traction cable 40A, 40B in comparison with the version with the motors 44A, 44B arranged at the top, so that the combination of guide rollers 52A, 52B and deflection rollers 50A, 50B enables an opening and closing of the housing 10 also with motors 44A, 44B arranged in the bottom region.

In an advantageous embodiment, at least one part, especially the part of the cantilever surface 32A, 32B, 34A, 34B extending towards the middle of the housing in the closed state can have a collapsible or foldable shape. For this reason, the cantilever surface

32A, 32B, 34A, 34B in the collapsible version is equipped with a hinge 33 arranged preferably in the region of the end bar 22A, 22B. This hinge permits the corresponding part of the cantilever surface 32A, 32B, 34A, 34B to be folded open or closed according to the position in the direction of the double arrow A (see Figure 9). Here, the folding direction of the folding angle and also the positions, at which the folding direction and folding angle can be changed, can be selected by corresponding control devices and/or cantilever properties. Thus, for example, the weight distribution of the cantilever surface 32A, 32B, 34A, 34B defines at which position during the movement of the end bar 22A, 22B the weight of the cantilever surface 32A, 32B, 34A, 34B moves this surface into a folded open or closed position. In addition, the movement of the cantilever surface 32A, 32B, 34A, 34B can be supported by means of mechanical devices. Thus, for example, in an embodiment, a pivot lever 51 is arranged on the region of the cantilever surface 32A, 32B, 34A, 34B facing the end bar. This lever experiences a force transfer from a contact roller 52 fixed in the upper, central region of the housing 10 during the movement of the end bar 22A, 22B into the closed state or out and consequently the cantilever surface 32A, 32B, 34A, 34B is folded about the hinge 33 into the horizontal closed state. This also then guarantees a secure closing of the housing 10 by the cantilever surface 32A, 32B, 34A, 34B, even if the hinge 33, for example, should be difficult to move and just the weight of the cantilever surface 32A, 32B, 34A, 34B would not be sufficient. In a modified embodiment, through the arrangement of a contact roller 52' in the top, side region of the housing 10, the cantilever surface 32A, 32B, 34A, 34B is moved during the movement of the end bar 22A, 22B into the top position into a vertical state, where, in contrast, for a lowering of the end bar 22A, 22B, the cantilever surface 32A, 32B, 34A,

34B is moved into a horizontal position (see Figures 10, 11). Such an arrangement is primarily advantageous when a crane arrangement, especially a craneway rail, is installed in the upper region of the housing (see Figure 11).

The same also applies equivalently for a foldable cantilever surface 32A, 32B, 34A, 34B, in which, next to the first hinge 33 there are other hinges 33', etc., arranged in the cantilever surface 32A, 32B, 34A, 34B. The number of hinges 33, 33', etc., their rotational directions, and also possible parallel linkages 35 determine the folding properties of the cantilever surface 32A, 32B, 34A, 34B. The folding movement can also be supported by preferably mechanical devices. In one variant, the parallel linkages 35 are equipped with a cam, which is activated during the movement of the end bar 22A, 22B by a contact roller and in this way the cantilever surface 32A, 32B, 34A, 34B is folded together.

Foldable or collapsible cantilever surfaces 32A, 32B, 34A, 34B are advantageous primarily for such housings, in which the remaining side rail height for an open housing should be as small as possible in order to load or unload a zinc tank stored in the housing from the side. In addition, it is also possible to reinforce the collapsible cantilever surface 32A, 32B, 43A [sic; 34A], 34B and to cover this with the cantilever surface 32A, 32B, 34A, 34B in the completely open state of the housing 10 for an arrangement of the wind-up shaft 24A, 24B under the floor to make it traversable.

The movement of the end bar 22A, 22B and thus the movement of the entire hanging 20A, 20B and the cantilever surface 32A, 32B is performed, as already explained, with the help of the drive 44A, 44B. In order that this drive is unloaded, a weight compensating device, e.g., a first counterweight 66A, 66B, is used, which compensates for the weight of the hanging 20A, 20B and the cantilever surface 32A, 32B. For this purpose, a bearing cable 64A, 64B, which runs over guide and deflection rollers 60A, 60B, 62A, 62B fixed to the upper end of the housing 10, is connected to the end bar 22A, 22B.

To take into account the different loads during the opening or closing of the housing 10, the counterweight 66A, 66B comprises two weights G1 and G2, wherein G1 is heavier compared with G2. The weight G2 is arranged so that it can move freely in the vertical direction preferably within the weight G1 and is connected to the bearing cable 64A, 64B, which can run through a top opening of the weight H1. Tensile force on the bearing cable 64A, 64B, which is caused, for example, by lowering of the hanging 20A, 20B, first raises accordingly the weight G2 until it strikes against the weight G1 and pulls this along accordingly upwards. Thus, according to the position, the counterweight features either the weight 0 (both weights on the floor), G2 (only G2 raised), or the total weight G1+G2 (both weights raised).

As to be inferred from Figure 6, the length of the bearing cable 64A, 64B and the position of the guide and deflection rollers 60A, 60B, 62A, 62B are selected such that the counterweight 66A, 66B is placed completely on the floor at a point, at which the cantilever surfaces are not completely closed, and consequently no counterweight force is

exerted on the end bar 22A, 22B. Therefore, this point defines the zero position of the counterweight 66A, 66B, so that both the end bar 22A, 22B is lowered in the open direction, and also the opposite closing movement raises the counterweight 66A, 66B (first G2, then G1).

In the closing direction, from the zero position only the smaller weight G2 is still raised, as is visible in Figure 7. This has the effect that in the closed position, at which the two cantilever surfaces 32A and 32B touch, that the counterweight exerts a force of G2 on the end bar, so that movement of the cantilever surface 32A, 32B is also enabled against possible friction resistance (static friction) and despite the small downwards force components generated by its own weight in the closed position.

As to be seen further in Figures 6 and 7, the hanging 20A, 20B can also be opened upwards from below by activating the wind-up drive 38A, 38B. Here, the top part of the hanging 20A, 20B, especially the end bar 22A, 22B, remains fixed at a desired position and the bottom part is rolled up by means of the wind-up drive 38A, 38B. In order to also remove loading from the wind-up drives 38A, 38B, the wind-up shaft 24A, 24B and the wind-up drive 38A, 38B driving these shafts are connected to a second counterweight 68A, 68B by means of a bearing cable 71A, 71B running over a deflection roller 70A arranged in the top region of the housing 10. This counterweight 68A, 68B is designed so that it compensates for the weight of the wind-up shaft 24A, 24B, the wind-up drive 38A, 38B, and partially the weight of the rolled up hanging 20A, 20B. It is inserted

in a preferably tubular receptacle 69A, 69B so that it can run freely in the vertical direction.

Another feature is that the guides 26A, 26B do not necessarily have to extend to the roof ridge. Instead, as shown, they end preferably clearly before the roof ridge, so that a gap of significant width is opened between their roof-side ends. For a lowered hanging, the gap opens a roof surface opening 30 going past the guides. Preferably end-wall seal openings 28 in the vertical direction connect to the roof surface opening. Thus, components longer than the factory length can be transported into the factory with a crane over the roof region (transport direction V) and can be transported out of the factory, e.g., in order to be able to treat very long components from both ends one after the other in a galvanic tank. Therefore, for end closing of the seal opening 28, corresponding gates 48A, 48B can be provided. For opening and closing the roof surface opening 30, cantilever surfaces 34A, 34B are used, which project past the ends of the guides 26A, 26B and can be designed as integral or mounted components of the end bars 22A, 22B.

Consequently, a sliding gate according to the invention comprises a hanging 20A, 20B,which can be wound up at the bottom end, and a raising and lowering end bar 22A; 22B, which is guided on both ends and which keeps the hanging ready. Such sliding gates are also worthy of inventive protection themselves and can also be used in rigid buildings.

Another advantage of the housings and/or sliding gates according to the invention is that they can also be used advantageously when craneway rails run perpendicular to the hanging, wherein it is then located above and optionally to the side of the hanging or the sliding gate and transport of goods into and out of the housing or into and out of a factory provided with a corresponding sliding gate is enabled from the side wall (transport direction H), i.e., in the direction of the sliding gate, without disturbing the housing or factory roof. Such applications also come into mind in other areas than the housing of galvanic tanks, such as, e.g., lacquer cabinets and similar warehouses, into which and out of which large workpieces must be transported with a crane - even when medium-size or even small sliding gate widths come into mind.

Finally, it is advantageous when the end bar 22A, 22B is equipped with at least one continuous suction channel or formed as a suction channel, as shown in Figure 8, for the housing according to the invention. The problem that the entire volume enclosed by the housing can be suctioned only through point-shaped suction openings frequently machined into the end wall 14A, 14B is therefore minimized, such that the end bar 22A, 22B equipped with at least one suction channel or formed as such a channel has suction slots 80A on the sides directed towards the interior of the housing 10 and thus enables suctioning over the entire length, wherein the suctioned volume can be discharged via an end opening 82A. The end bar 22A, 22B is connected to an opening in the end wall, preferably in a fluid-tight way, for a closed housing, so that the suctioned volume can be discharged to the outside. The distance between the end bar 22A, 22B and the opening of the end wall can be sealed with rubber lips 84A.